Figure 1: Black Box Block Diagram

Figure 2: Top-Level Block Diagram
<table>
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<th>Interface Name</th>
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</table>
| Stop_Button       | ● Digital HIGH (5V) or LOW (0V)  
● Not pressed = LOW via pull-down resistor  
● Button that the user can press to stop the current audio function  
● \( V_{\text{min}} \): 0V  
● \( V_{\text{max}} \): 5V  
● \( V_{\text{cc}} \): 5V  
● \( I_{\text{max}} \): 1A |
| Song1_Button      | ● Digital HIGH (5V) or LOW (0V)  
● Not pressed = LOW via pull-down resistor  
● Button that the user can press to play the first pre-recorded song (DK Rap)  
● \( V_{\text{min}} \): 0V  
● \( V_{\text{max}} \): 5V  
● \( V_{\text{cc}} \): 5V  
● \( I_{\text{max}} \): 1A |
| Song2_Button      | ● Digital HIGH (5V) or LOW (0V)  
● Not pressed = LOW via pull-down resistor  
● Button that the user can press to play the second pre-recorded song (Gangplank Galleon)  
● \( V_{\text{min}} \): 0V  
● \( V_{\text{max}} \): 5V  
● \( V_{\text{cc}} \): 5V  
● \( I_{\text{max}} \): 1A |
| Record_Button     | ● Digital HIGH (5V) or LOW (0V)  
● Not pressed = LOW via pull-down resistor  
● Button that the user can press to begin recording 20 seconds of audio  
● \( V_{\text{min}} \): 0V  
● \( V_{\text{max}} \): 5V  
● \( V_{\text{cc}} \): 5V  
● \( I_{\text{max}} \): 1A |
| Play_Recording_Button | ● Digital HIGH (5V) or LOW (0V)  
● Not pressed = LOW via pull-down resistor  
● Button that the user can press to play the recorded audio file  
● \( V_{\text{min}} \): 0V  
● \( V_{\text{max}} \): 5V  
● \( V_{\text{cc}} \): 5V  
● \( I_{\text{max}} \): 1A |
| User_Knob_Selection          | 3 Analog Knobs (Red, Blue, Green)  
|                             | User adjusts knobs to create different color combinations and intensities on the RGB LEDs  
|                             | Vcc: 5V  
|                             | Rmin per Knob: 100 Ohms  
|                             | Rmax per Knob: 10 kOhms  
| Audio_Selection             | Digital HIGH (5V) or LOW (0V)  
|                             | Prompts the microcontroller block to begin one of four audio functions depending on which button was pressed  
|                             | Vmin: 0V  
|                             | Vmax: 5V  
|                             | Imin: 0A  
|                             | Imax: 40mA  
|                             | Inom: 20mA  
| Stop_Function               | Digital HIGH (5V) or LOW (0V)  
|                             | Prompts the microcontroller block to stop all audio functions if the stop button was pressed  
|                             | Vmin: 0V  
|                             | Vmax: 5V  
|                             | Imin: 0A  
|                             | Imax: 40mA  
|                             | Inom: 20mA  
| LED_Analog_Color_Choice     | Analog Signal  
|                             | Specifies the color and intensity of the RGB LEDs depending on the knob adjustment levels  
|                             | Vmin: 0V  
|                             | Vmax: 5V  
|                             | Imin: 0A  
|                             | Imax: 80 mA  
| Button_Knob_Power           | DC Signal  
|                             | Supplies power to the buttons and knobs on the User Interface  
|                             | Vmin: 4.5V  
|                             | Vmax: 5.5V  
|                             | Vnom: 5V  
|                             | Inom: 100mA  
|                             | Ipeak: 150mA  

| **Play_Song** | • PWM Signal  
• Outputs audio signal corresponding to the user selected song to the Audio Circuit for filtering and amplification  
• Vmin: 0V  
• Vmax: 5V  
• Imin: 0A  
• Ipeak: 40A |
| **Analog_Audio_In** | • Analog signal  
• Generated signal from the Audio Circuit microphone received by the Arduino UNO for recording  
• Vmin: 0V  
• Vmax: 5V  
• Imin: 0A  
• Ipeak: 40A |
| **Nmos_PWM_Control** | • PWM Signal  
• Used to control when the figurine spins as well as the RPM of the figurine  
• Sent to gate of nmos transistor  
• Vmin: 0V  
• Vmax: 5V  
• Inom: 0A  
• Ipeak: 0A |
| **Microcontroller_Power** | • DC Battery Voltage  
• Powers the Arduino UNO  
• Vmin: 6V  
• Vmax: 20V  
• Vnom: 9V  
• Inom: 1A  
• Ipeak: 1.5A |
| **Motor_Power** | • DC Battery Voltage  
• Powers the motor on the Motor-Controlled Figurine  
• Vmin: 0V  
• Vmax: 5V  
• Vnom: 5V  
• Inom: 100mA  
• Imin: 0A  
• Ipeak: 400mA |
| Mic_Input                      | ● Analog Signal  
|                              | ● Audio played to the microphone on the Audio Circuit  
|                              | ● Freqmin: 20 Hz  
|                              | ● Freqmax: 8 kHz  
| Music_Out                     | ● Audio  
|                              | ● Speakers on the Audio Circuit produce audio depending on the input to the Audio Circuit in Play_Song  
|                              | ● Freqmin: 20 Hz  
|                              | ● Freqmax: 20 kHz  
| Power_Audio                   | ● DC Linearly Regulated  
|                              | ● Vmin: 4.5V  
|                              | ● Vmax: 5.5V  
|                              | ● Vnom: 5V  
|                              | ● Imin: 0A  
|                              | ● Ipeak: 600mA  
| Spinning_Figurine             | ● DK Figurine  
|                              | ● Spins when music is playing, doesn’t spin when music is not playing  
|                              | ● Max RPM: 24  
| LED_Power                     | ● DC Linearly Regulated  
|                              | ● Vmin: 4.5V  
|                              | ● Vmax: 5.5V  
|                              | ● Vnom: 5V  
|                              | ● Imin: 0A  
|                              | ● Ipeak: 80mA  
| RGB_Light_Out                 | ● 6 RGB LEDs  
|                              | ● Analog brightness chosen by user via knobs  
|                              | ● Analog color chosen by user via knobs  

Table 1: Interface Definitions